Library Communication Systems

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COMMUNICATION, in the mechanistic sense connoted by this issue, may be broadly defined as the technology of conveying information. This broad definition would include the library itself, which, as a social institution, is a technical instrument for the transfer of information.

This paper, however, is concerned with but one aspect of the communication complex: the application of communication technology to certain library functions, namely:

1. Conveyance of administrative information (i.e. that controlling library services and traffic.)
2. Conveyance of information derived from the library's resources (i.e. reference work in its many forms.)
3. Conveyance of information recorded in the resources themselves (i.e. the lending of materials.)

Definitions are always arbitrary, and despite the fact that logic should prevail, discussion of the following communication techniques has been excluded from this paper: pneumatic tubes, microfilm, radio, and television. These are discussed elsewhere in this issue. The audio-visual media are immensely important in today's world, and have worked to condition the library's role as an instrument of mass communication. The communication systems to be described in this paper, while they relate to basic library functions, have received less attention in the professional literature.

Communication is a function of complexity; the larger the institution or the library system and the more complex its activities, the greater the need for administrative communication. In this the library is one with industry, commerce, and government. Information must be collected for decisions; decisions must be communicated; questions must be asked and answered, instructions given and received. Libraries have usually borrowed communication devices and systems, there-

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fore, from the business world. Here, new devices and suggested applications are frequently reported in such periodicals as *Management Methods* and *Systems,* and the librarian interested in systems developed would be well advised to follow them.

Among the oldest devices for vocal communication is, of course, the telephone. It is interesting to speculate how much American libraries owe their development to this instrument. Certainly they have come a long way since the innovation of telephone reference service in the St. Louis Public Library so overburdened the exchange that the operators refused to handle library calls.[1] The use of telephone systems for external and internal communication is now axiomatic.

There are, in addition, special telephone system adaptations, some of which libraries have used successfully, for internal communication. For example, the Bell Telephone System offers a "dial intercom" arrangement for standard instruments. Intercom systems, or two-way private telephone lines fitted either with conventional handsets or with speaker and microphone desk sets, exist primarily for the purpose of enabling an administrator to consult with his staff, either singly or in conference. Intercoms have become increasingly popular both in newly planned libraries, and in remodelled buildings.

The physical size of the building, the complexity of the library's functions, the size and the organizational pattern of its staff appear to be the principal factors determining the decision to install an intercom. The Brooklyn Public Library reports not only a private intercommunication system of telephones in its Central Service, but also its intention to install an intramural dial system for the whole building.[2] The Armed Forces Medical Library has planned two intercom systems for its new building, one with nine stations for administrative control, and one with ten for circulation desk to stack communications.[3] Such intercommunication between the circulation desk and stacks appears to be a less common application than the administrative one. In a closed-stack library, despite the advantages enjoyed by graphic communication, a vocal intercom system offers much to speed service.

Telephone answering services (familiar to all who dial for the weather report) and telephone message recorders, both available through the Bell System, would have limited application in special library situations; the literature discloses no evidence of their use.

Public address systems or paging devices, for obvious reasons, have been less popular with libraries than intercoms. Commonly, these are one-way systems using a microphone, amplifier, and one or more speakers. Possible library applications include communication between

the circulation desk and closed stacks (analogous to the sales-counter-to-stockroom communication of business), and public paging. A few specialized libraries in hospitals or medical centers, where such public address system installations are common, take advantage of them to communicate with readers.

An interesting device now used in hospital situations is the vest pocket radio, the "Pagemaster", produced by Electronic Systems Control, Los Angeles, California. A receiver, tuned in to a predetermined wave length, is charged out to the doctor. When the switchboard operator dials the number of the receiver, a radio signal activates a buzzer in the receiver, and its owner goes to the nearest phone to receive the message.

In distinction to the above audio systems, the Telautograph provides the receiver with a graphic record. This system permits the writing of a message on a continuous roll paper form in a transmitter and its simultaneous reception in facsimile form on one or more receivers. It has been installed in a number of libraries for intercommunication between the circulation desk and the stacks. It has, of course, the obvious advantage of providing an accurate graphic record of the information communicated: the call number of a book, citation in a periodical, or report of a search. TelAutograph has one advantage, reception is automatic, and messages may accumulate to be collected at convenience.

A handwritten communication system has advantages where there is dependence on a central library record. Thus, at the John Crerar Library, TelAutograph is used to send information from the shelflist to service points. The efficiency of the telautograph with pneumatic tube communication is compared in the article on transportation equipment. The equipment is leased, rather than sold; information is available from TelAutograph Corp., 1128 Crenshaw Blvd., Los Angeles, California.

Annunciators are visible signalling devices used to notify patrons of large closed-stack libraries that the material requested, or information relating to it, is available. Serial numbers corresponding to a seat number or a ticket are flashed on a large panel located over the circulation desk. The system is analogous to the visual paging devices used for doctors in many hospitals. That in the Reference Department of the New York Public Library is, of course, the classic example. It was locally constructed by staff electricians. The Butler Library at Columbia University offers an example of a more modern installation.

Closed-system or industrial television apparently has not yet been

used in library situations. Early in 1952 the Library of Congress experimented briefly with ITV for reference and verification; an L.C. card or a bibliographical reference could be scanned in one area and viewed in another.[4] Where a permanent copy is not needed, ITV offers distinct possibilities in conveying information. The use of ITV by banks to compare check endorsements with a master signature in a remote file suggests other library uses. Yet another management use, again borrowed from industry, would be the monitoring of library building exits to reduce depredation and vandalism.

To sum up the administrative uses of modern communication systems in libraries, it would be fair to say that, in recent years, they have proliferated where size and complexity have made conditions favorable. They have been borrowed extensively from business and industry, and reflect recent rapid development of electronic techniques. Generally speaking, however, the nature of the applications has been conservative; libraries themselves have not pioneered in developing new techniques for internal communication.

By contrast, American libraries have been bolder in finding new types of uses for interlibrary communication. The philosophic and economic bases for increased library interdependence, and hence communication are well-known, and the trend has been well reviewed by McAnally,[5] Carlson,[6] Fussler,[7] and others.[8] Competition for library resources has become uneconomic, and specialization, as demonstrated by the Farmington Plan, has become a necessity of research library development. Specialization implies cooperation and intercommunication; therefore, it behooves libraries to experiment with communication devices which promise to facilitate the sharing of each other's resources.

Interlibrary communication may therefore be considered as a necessary complement to the scattering of resources. Further, it may be considered as a control on uneconomic competition in library development.[9] Such communication makes possible the establishment of "satellite" systems wherein a metropolitan or regional library may service the extraordinary demands of peripheral service libraries.

Interlibrary communication has taken two forms: the first is concerned with the transmittal of information about the library's resources, and the second with transmittal of facsimiles of the resources themselves. The former is an adjunct to the library's reference services, the latter to its loan service. This distinction, based in part on the characteristics of the instrumentation available, has not always been made in library planning.

Foremost among interlibrary communication systems applied to the transmission of information derived from the library's resources is, of course, the Teletypewriter Exchange System, or TWX. Essentially this is a national (and international) closed telegraphic system offering service on a rental basis. Messages are typed on a teletypewriter, which converts them to electric impulses which, at the receiving end, are reconverted to type automatically. Jolly has reviewed the development and use of TWX in the United States up to 1954.[10] The first library installation, made in January 1950, connected the public libraries of Milwaukee and Racine.[11] It developed from the need of the "satellite" libraries to borrow materials frequently from the larger metropolitan system. Racine is an industrial community; thus it is significant that in a three-months spot check, 45 per cent of the 248 books borrowed from Milwaukee were scientific or technical. Racine's primary purpose was to reduce the time for making interlibrary loans, later to be picked up by a messenger, by wiring requests in advance. A secondary purpose was to receive quick answers to reference questions.

Original estimates for the RACMIL system established a cost of 77 cents per item borrowed, including the prorated cost of equipment rental, messenger's time, and a Milwaukee Public Library service charge of 22 cents a volume. The estimated cost of answering a reference question was set at 60 cents. When the TWX rental cost doubled in July 1953, these cost figures were redetermined at $1.02 per item for borrowing, and 75 cents per reference question answered.[12] Recent experience has shown a decline in items requested by RACMIL, attributed in part to the development of information resources in the industrial firms serviced, but the RACMIL circuit is still continuing.

The "Michigan Circuit" was established by the University of Michigan, the Detroit Public Library, the Grand Rapids Public Library, and the Michigan State Library, to help meet cooperatively the emergency caused by the Michigan State Library fire in March 1951. During its brief career, it was very successful in permitting state-wide library cooperation, but it became a victim of the sharply increased rental charges inaugurated in 1953.[10]

The most ambitious TWX installation has been that developed as a service adjunct to the Midwest Inter-Library Center, Chicago. The system was established to provide quick access to materials deposited by the sixteen research library members to the materials placed in storage at the Center. Fourteen of the sixteen libraries installed TWX

equipment, and the major cost of the service until 1956 was borne by the cooperatively budgeted MILC. The total annual cost to the Center has been estimated at $2,767. The traffic has not been as heavy as was originally anticipated, there being but 464 requests received between October 1954 and September 1955. The cost per unit for this period, averaging both incoming and outgoing messages, came to $2.36.[13] The increased cost and the decreased traffic have been a matter of concern to MILC's directors, a number of whom believe firmly that the actual and potential value of the system warrant its retention.

As an adjunct to its "common pool policy" which considers the eight separate library systems of the University of California as a large reservoir from which the faculty and graduate students of any campus can draw, the University of California has established a TWX system designed to facilitate their intercommunication. It is used primarily to reduce the time taken by interlibrary loans and to answer reference questions from specialized resources. A potential use is its substitution for a proposed union catalog.[14]

Other single installations of TWX include one between the Linda Hall Library and the University of Kansas Library,[15] and one at the Denver Bibliographical Center. A recent variant is the Library of Congress' use of its TWX in speeding orders to booksellers.[16]

There is no doubt but that the 1953 price increase on TWX messages slowed down a highly significant interlibrary communication development. Whether this dealt a death blow to the possibilities of rapid telegraphic information about books is essentially a problem involving the economic value of the information sent and received. The Midwest Inter-Library Center is handicapped in one sense in that the materials deposited with it were considered of marginal value originally. Present-day society assigns higher cash values to information in the sciences and technologies, and presumably further development of TWX will be along lines where the system "pays off."

As contrasted with a system which expedites conventional library reference services, facsimile reproduction offers a substitute for the loan of library materials themselves. Interlibrary loans are expensive, they are slow, they preclude the local use of materials during the course of the loan, and they are risky. The use of microfilm in lieu of loan owes its strength to the fact that it obviates some of these difficulties. Microfilm is a facsimile recorded by a photographic process and transmitted by mail. It is cheap, it permits retention of the material "loaned," but its transmission by mail is still slow and cum-

bersome. From its earliest application to library service, microfilm has offered an attractive substitute for interlibrary loan.[17]

More recently, the communications industry has developed new techniques for the instantaneous facsimile transmission of information. The objective of those interested in advancing interlibrary facsimile communication is to find, develop, and apply one of these techniques as a cheap and rapid substitute for interlibrary loan.[18] Efforts so far have been concentrated in the scientific-technical library area, since the unit of information required, the scientific-technical paper averaging ten pages, lends itself economically to electronic transmission.

Facsimile transmission, as a "black box" concept, is relatively simple. The copy to be scanned is moved under a zig-zagging pencil point of light. A reflection of this light spot is sensed by a photo-cell; wherever black occurs—for example the ascender line of the letter "b"—the photo-cell generates a "blip," or a modulation on a basic carrier wave. These "blips" are transmitted by telephone or high frequency radio to a recording device, where they are reconverted to graphic images. The technique has long been in use for the transmission of radiophotographs.

The standard equipment used for radiophotographs and the devices now being developed and sold for industrial use have the disadvantage of being "drum scanners," designed to accommodate a single sheet of paper locked, like a mimeograph stencil, around a slowly revolving drum. On the other hand some new RCA equipment, developed according to the specifications of the Atomic Energy Commission for a library situation at Oak Ridge,[19] is a "flat bed" scanner which incorporates a book holder similar to a microfilm camera cradle. Its other distinguishing feature is its relatively high speed; where photos are commonly sent at a rate of four inches a minute, the RCA model moves copy at a maximum rate of fifteen.

At Oak Ridge, where the equipment was first installed, several factors mitigated against its success.[20, 21] It was later moved to Washington, loaned to the Library of Congress, and tried first as a communication link between that library and the National Institutes of Health, and later between the Armed Forces Medical Library and the National Institutes of Health. Largely for mechanical reasons, the Washington experiments with the prototype equipment have been less than successful. During a period of maximum productivity (July-November 1954) 140 transmissions of periodical articles averaging ten pages in length were made at an estimated unit cost of $3.92 or 39

cents per page. At 200 transmissions per month the unit cost could have been reduced to $1.53.

The general conclusions reached as a result of the Washington experience were:

1. Facsimile as a substitute for interlibrary loan is acceptable to the user. While there is room for improvement, legibility is satisfactory. Particularly appreciated were the retention factor and the relative speed of service.
2. Facsimile can compete with loan and photoduplication only if sufficient volume is attained.
3. The industrial development of facsimile for interlibrary communication should be continued.

Warheit [21] has pointed out the pitfalls in predicating service on experimental equipment, and Shaw [22] has suggested the limitations imposed by its maximum theoretical daily capacity (480 pages). In forecasting the future development of interlibrary facsimile communication, therefore, it is necessary to proceed temperately. The point should be made that experimental equipment demonstrates potentiality, rather than actuality. Pioneer television was costly, subject to breakdown, and inefficient.

The limitations involved in facsimile communication are the limitations demonstrated by one experimental model, the RCA remote high-speed facsimile duplicator. Scanning speed, as suggested by the Ultrafax demonstration [23] is more than satisfactory, it is recording speed which is the bottleneck. A high speed recording, preferably non-photographic, of an entire page on the face of an iconoscope tube, would reproduce an entire page in a matter of seconds.

Librarians both in this country and overseas have maintained a close interest in facsimile development.[24] In general, they are divided between those who see in interlibrary facsimile communication a major development which will profoundly affect the course of research libraries,[9, 18, 25] and those who remain skeptical of the potentialities of the equipment.[21, 22] Perhaps too much has been written on the basis of too little experience, and more tests are needed with a variety of devices before the question can be resolved. At any rate industrial facsimile communication is developing at a rapid rate.[26] The problem of further development is essentially that of creating a library market for the industry.

As for the future it would be well to review the conditions which must underlie further development in interlibrary communication:

First there must be economic advantage. A facsimile system should offer the promise of savings. It must do the same thing accomplished by interlibrary loan better and at less cost. It would thus have the potential of curtailing duplicative expenditure for library collections so that competitive acquisition may be sharply reduced. Actually, a system is most likely to develop where the information it supplies must be found quickly. Speed of communication is of more value in the sciences and technologies and in commercial enterprises than in the humanities.

Second, as a prerequisite to the development of a communications system, there must be a homogeneity of interest among the individual units to be joined together by the system. The library complex of a given metropolitan area, or of a given geographic region, suggests a functional basis for systems development. This is the repository-satellite relationship, which may take dozens of forms, but which is a fundamental condition to the establishment of a system.

Third, the system must be designed to transmit only such parcels of information as are economically defensible. An encyclopedia article is one thing; *Gone With the Wind* is another. Short units, such as scientific papers, law reports, specifically cited pages in periodicals or books, at present, constitute the economic unit.

Fourth, if libraries wish to adapt facsimile communication to their functions, they have the responsibility of making their needs known, and of promoting the commercial development of equipment meeting library requirements. A rapidly developing field will of course seek a profitable market,[26] and, so far, industrial applications have offered the greatest stimulus to design and experimentation. Libraries interested in improving their intercommunication have the responsibility of making their needs known.

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